ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603801A Aviation - Advanced Development

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	10996	8655	5848	9071	9402	10204	10290	Continuing	Continuing
DB32 Advanced Maintenance Concepts and Equipment	2495	2972	3034	3421	3541	3788	3883	Continuing	Continuing
DB33 Cargo Handling and Mission Support Equipment	2296	2740	2814	2985	3191	3496	3495	Continuing	Continuing
DB45 Aircrew Integrated Systems - Advanced Development	6205	2943	0	2665	2670	2920	2912	Continuing	Continuing

A. Mission Description and Budget Item Justification: This PE provides advanced development aviation support of tactical programs associated with air mobility, advanced maintenance concepts and equipment, and Aircrew Integrated Systems (ACIS).

B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	11404	5746	5870
Appropriated Value	11487	8746	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-83		
b. SBIR / STTR	-256		
c. Omnibus or Other Above Threshold Reductions		-31	
d. Below Threshold Reprogramming	-108		
e. Rescissions	-44	-60	
Adjustments to Budget Years Since FY 2000/2001 PB			-22
Current Budget Submit (FY 2001 PB)	10996	8655	5848

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603801A Aviation - Advanced Development PROJECT DB32

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DB32 Advanced Maintenance Concepts and Equipment	2495	2972	3034	3421	3541	3788	3883	Continuing	Continuing

A. Mission Description and Budget Item Justification: This project enhances utilization of current and future aircraft by improving the efficiency of maintenance and servicing operations by validating new maintenance concepts to improve man machine interface, enhance aircraft maintenance processes and reduce operation and support costs. Included in the project are Digitized Aviation Logistics (DAL) elements such as: Portable Maintenance Aids (PMA), database management software, on-board diagnostics, health/usage monitoring systems, trending analysis, automated data collection and migration, business process reengineering, software integration, and support infrastructure analysis.

FY 1999 Planned Program:

- 175 Completed development and demonstration of Aircrew Maintenance Interface Debriefing System (AMIDS). Demonstrated system for Apache PMO and performed an implementation study for including AMIDS functionality in the Longbow Integrated Maintenance Support System (LIMSS).
- 40 Performed Cost/Benefit analysis on Structural Usage Monitoring System (SUMS) for the MH-47E based upon information gathered during system demonstration.
- 25 Monitored Small Business Innovative Research (SBIR) programs focused on applying acoustic monitoring to the diagnosis of aircraft mechanical system faults.
- 550 Initiated development of a Structural Usage Monitoring System (SUMS) for the Apache Longbow. This system analyzes flight regime and aircraft configuration information to calculate component usage. Detailed requirements have been defined and preliminary design has begun.
- 225 Initiated development of a system for collecting and analyzing data available from the Full Authority Digital Electronic Control (FADEC) on the T55-GA-714 engine. Defined detailed requirements and began preliminary design. Program Name: Aviation Diagnostic & Engine Prognostic Technology (ADEPT).
- 400 Defined plan for demonstrating the use of Automated Identification Technology (AIT) in the Army aviation maintenance process. Effort included technology survey, coordination with other DoD organizations, and detailed program planning.
- 1080 Initiated effort to define, develop, and demonstrate a seamless information system that allows information to flow from on-board aircraft systems, through electronic diagnostic tools, into the larger logistics information system. Effort included assembling a team of Government and industry personnel to define a unit level information system architecture and to define future information requirements for PMs, manufacturers and materiel managers.

Total 2495

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
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	PROJECT DB32

FY 2000 Planned Program:

- 1115 Longbow SUMS: complete preliminary and detailed designs, develop software algorithms, and begin field data collection and analysis.
- 550 ADEPT: complete preliminary and detailed designs, develop software for data collection and trending, begin field data collection and analysis.
- 450 Define standardized maintenance decision support tools for use by unit level personnel.
- 661 Begin development of unit level seamless information system.
- 132 Support AMCOM Automated Identification Technology demonstration effort.

64 Small Business Innovative Research/Small Business Technology Transfer Program (SBIR/STTR)

Total 2972

FY 2001 Planned Program:

- 502 Longbow SUMS: complete field demonstration and present results to Apache PM.
- 650 ADEPT: complete field demonstration and present results to Chinook PM.
- 150 Continue to support AMCOM demonstration of Automated Identification Technology for use in helicopter maintenance processes. Prepare for application to the Longbow Apache.
- 1088 Continue development of unit level seamless information system by interfacing existing digital information systems and automating maintenance record keeping and support processes.
- 644 Begin development and demonstration of maintenance decision support tools for use by unit level personnel.

Total 3034

B. Other Program Funding Summary: None

C. Acquisition Strategy: This project is an aggregate of advanced maintenance concepts-related projects. While the detailed acquisition strategy varies from project to project, the general strategy for each individual project is to complete the development effort through Government test (developmental and operational). Program documentation for milestone decision is prepared, as appropriate, concurrently with the development effort in preparation for program transition to the organization responsible for production and fielding.

D. Schedule Profile	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Longbow SUMS									
Define System and Develop Methodology	3Qtr								
Develop Algorithms		2Qtr							
Demonstrate			1Qtr						
ADEPT									
Define System and Develop Methodology	3Qtr								
Develop Algorithms		3Qtr							

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PROJECT: DB32

D. Schedule Profile	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Demonstrate			4Qtr						
Digital Aviation Logistics Prototype									
Maintenance AIT Application									
Define System and Methodology	3Qtr								
Work Implementation Issues		2Qtr							
Preliminary Demonstration		3Qtr							
Enhanced Demonstrations			2Qtr						
Single-Point Data Access									
Define Unit Level Architecture	3Qtr								
Develop Interfaces		2Qtr							
Interface Demonstration		4Qtr							
Enhanced Demonstrations			2Qtr						
Maintenance Decision Support Tools									
Define Automated Phase Maint. Tool		2Qtr							
Develop Tools			2Qtr						
Demonstrate Tools			4Qtr						
Maintenance Information Analysis Tools				2Qtr					
Unified Demonstration of Seamless System				2Qtr					
Development of Diagnostic / Prognostics Tools				2Qtr					

ARMY RDT&E COST ANALYSIS (R-3)

DATE: February 2000

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603801A Aviation - Advanced Development

PROJECT: DB32

I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. Longbow SUMS	SS/CPFF	The Boeing Company, Mesa, AZ	0	765	3rd Qtr	1115	1st Qtr	502	1st Qtr		2382	1800
b. ADEPT	CA/CR	Allied Signal, Tempe, AZ	0	225	3rd Qtr	550	1st Qtr	650	1st Qtr		1425	1150
c. AIT Maint. Application	PO/FFP	Intermec, Everett, WA	0	425	3rd Qtr	132	2nd Qtr	150	2nd Qtr		707	600
d. Single-Point Data Access	CA/CR	Rita, Easton, MD	0	1080	3rd Qtr	661	2nd Qtr	1088	2nd Qtr		2829	2400
e. Maint. Decision Support Tools	CA/CR	Rita, Easton, MD	0	0		450	1st Qtr	644	2nd Qtr	850	1944	1700
f. SBIR/STTR						64					64	
g. OSD Withhold												250
Subtotal Product Development:				2495		2972		3034		850	9351	

II. Support Costs: None

III. Test and Evaluation: None

IV. Management Services: None

Project Total Cost:				2495		2972		3034		850	9351	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603801A Aviation - Advanced Development PROJECT DB33

COST (*In Thousands*)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DB33 Cargo Handling and Mission Support Equipment	2296	2740	2814	2985	3191	3496	3495	Continuing	Continuing

A. Mission Description and Budget Item Justification: This project develops equipment, practices, and procedures for the operational improvement of planning, loading, transport, and off-loading of helicopter cargo in all-weather, around the clock combat scenarios. It also replaces obsolete and insupportable ground support equipment with new and standardized multi-output equipment compatible with all Army aircraft models; develops rapid battle repair procedures and tools to speed the return of aircraft to combat ready status; and develops new equipment for aerial recovery of damaged aircraft.

FY 1999 Planned Program:

• 706	Completed the expert engine/aircraft-interface diagnostic databases, and initiated development of ATEDS for the force modernized fleet
• 555	Identified performance requirements and initiated design of replacement for Aviation Ground Power Unit (AGPU) to meet the needs of the force modernized fleet
• 260	Complete preliminary design of objective CANDID system, identifying hardware, software, and packaging requirements
• 216	Completed installation of ACHS in National Guard aircraft. Initiated system upgrades to a production configuration
• 243	Initiate effort to detect, characterize, treat, and prevent hidden corrosion in aircraft structures; building on detection capability being developed under the CANDID effort and the Navy's ongoing treatment and prevention activities
• 266	Completed fabrication, tested and accepted non-compliant system (ACDS). Initiated additional testing of prototype to clarify requirements.
• 50	Completed CMEP power electronics, completed vehicle installation kit, installed in vehicle, and test
Total 2296	

FY 2000 Planned Program:

• 329	Develop and execute an acquisition strategy to identify source that meets the Army ACDS requirement. Conduct laboratory tests
• 514	Complete detail design of CANDID hardware and software, and fabricate 3 prototype systems
• 561	Completed fabrication and test AGPU replacement prototype system. Initiate fabrication of 2 additional prototypes and initiate field tests
• 285	Resolve interface issues with ACHS and internal fuel tanks. complete system upgrades to a production configuration. Conduct qualification testing of ACHS subsystems.
• 605	Complete detail design of ATEDS hardware and software and initiate fabrication of prototype hardware. Initiate field demo.
• 389	Identify corrosion causing parameters and develop algorithm to calculate degree of corrosion development, initiate detail design efforts of corrosion environment monitoring system.
57	Small Business Innovative Research/Small Business Technology Transfer Program (SBIR/STTR)
Total 2740	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603801A Aviation - Advanced Development
PROJECT DB33	

FY 2001 Planned Program:

- 262 Conduct field testing of prototype CANDID systems and develop product/performance specification for follow on procurement
- 777 Complete field tests and develop production acquisition strategy for AGPU replacement.
- 425 Expand ACHS I efforts to meet identified deficiencies through initiation of additional technology development (ACHS II) in the areas of remote external cargo monitoring, high capacity external cargo winches, and automated weight and balance subsystems
- 787 Complete fabrication of ATEDS prototypes and complete field evaluation
- 348 Complete detail design efforts, fabricate corrosive environment monitoring system and conduct field evaluation.
- 215 Conduct field tests of ADCS

Total 2814

B. Other Program Funding Summary: None

C. Acquisition Strategy: This project is an aggregate of advanced mission support and cargo handling concepts-related projects. While the detailed acquisition strategy varies from project to project, the general strategy for each individual project is to complete the development effort through Government test (developmental and operational). Program documentation for milestone decisions is prepared, as appropriate, concurrently with the development effort in preparation for program transition to the organization responsible for production and fielding.

D. Schedule Profile	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Contact Maintenance Electrical Power (CMEP)							
Preliminary Design Review							
Detailed Design Review	2Qtr						
Fabrication (1)	3Qtr						
Test	4Qtr						
Aviation Turbine Engine Diagnostic Sys (ATEDS)							
Complete database development	2 Qtr						
Preliminary Design Review	4 Qtr						
Detailed Design Review		3Qtr					
Fabrication (3)		4 Qtr					
Test			4Qtr				
Aircraft Cleaning and Deicing System (ACDS)							
Fabrication (1)	2Qtr						
Test	2Qtr						
Identify source		1Qtr					

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603801A Aviation - Advanced Development

PROJECT: DB33

D. Schedule Profile	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Design review		2Qtr					
Fabrication		3Qtr					
Test	4Qtr						
Field test		4Qtr					
Develop production strategy			1Qtr				
Computer Aided Nondestructive Inspection and Disposition (CANDID) System							
Preliminary Design Review	4Qtr						
Detailed Design Review		2Qtr					
Fabrication (3)			1Qtr				
Test			2Qtr				
AGPU Replacement							
Preliminary Design Review	3Qtr						
Detailed Design Review	4Qtr						
Fabrication (1)		1Qtr					
Test		2Qtr					
Fabrication (2)		4Qtr					
Field Test			2Qtr				
Advanced Cargo Handling System (ACHS)							
Phase I Test							
Phase 2 Preliminary Design Review			4 Qtr				
Phase 2 Detailed Design				4 Qtr			
Fabrication (1)					4 Qtr		
Test						4 Qtr	
Corrosion Environment Monitoring System							
Preliminary Design Review	3Qtr						
Detailed Design Review		1Qtr					
Fabrication		2Qtr					
Test		4Qtr					
Low Observable Battle Damage Repair (LOBDR)							
Preliminary Design Review		4Qtr					
Detailed Design Review			4Qtr				

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603801A Aviation - Advanced Development

PROJECT: DB33

D. Schedule Profile	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Fabrication				4Qtr			
Test					4Qtr		
Stress/Fatigue Identification							
Complete Stress ID Survey		1Qtr					
Preliminary Design Review			1Qtr				
Detailed Design Review			2Qtr				
Test			4Qtr				
Advanced Lightweight GPU							
Preliminary Design Review				4Qtr			
Detailed Design Review					2Qtr		
Fabrication (3)					4Qtr		
Test						1Qtr	
Environmentally Friendly Deicing Technologies							
Market research and identify			3Qtr				
Develop prototype system				2Qtr			
Fabricate and field trials					1Qtr		
Contact Maintenance Air Compressor							
Develop prototype				3Qtr			
Fabricate & field trials					2Qtr		

ARMY RDT&E COST ANALYSIS (R-3)

DATE: February 2000

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603801A Aviation - Advanced Development

PROJECT: DB33

I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. CMEP	PO	In-House	165	50						0	215	
b. ATEDS	C/CPFF	AlliedSignal, Phoenix, AZ; Allison, Indian-apolis, IN; Sikorsky, Stratford, CT	1256	856	1st Qtr	605	1st Qtr	585	1st Qtr	0	3302	1754
c. ACDS	C/CPFF	Centech, Arlington VA	254	266	3rd Qtr	329	1st Qtr	160	1st Qtr	0	1009	220
d. CANDID	SS/CPFF	Boeing, Mesa AZ	628	210	2nd Qtr	514	2nd Qtr	195	2nd Qtr	0	1547	750
e. AGPU Replacement	C/CPFF	Rome Labs, Rome, NY	0	505	2nd Qtr	561	1st Qtr	575	1st Qtr	0	1641	1500
f. ACHS	C/CPFF	In-House, TBD	911	216	2nd Qtr	285	2nd Qtr	316	2nd Qtr	0	1728	700
g. CEM (Corrosive Envmt Mtr)	CA	Honeywell, Minneapolis, MN	0	193	3rd Qtr	389	1st Qtr	259	1st Qtr	1019	1860	2081
h. LOBDR	C/CPFF	TBD				0	3rd Qtr	450	2nd Qtr	1000	1450	1342
i. Stress/Fatigue ID	C/CPFF	TBD				0	3rd Qtr	106	2nd Qtr		106	
j. Adv Ltwt GPU	C/CPFF	TBD										
k. EnvFriendly Deicing	C/CPFF	TBD						168	1st Qtr		168	
l. SBIR/STTR						57					57	
m. Cont. Maint Air Comp	C/CPFF	TBD										
Subtotal Product Development:			3214	2296		2740		2814		2019	13083	8347

II. Support Costs: None

III. Test and Evaluation: None

IV. Management Services: None

Project Total Cost:			3214	2296		2740		2814		2019	13083	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY: 4 - Demonstration and Validation	PE NUMBER AND TITLE: 0603801A Aviation - Advanced Development / PROJECT: DB45

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DB45 Aircrew Integrated Systems - Advanced Development	6205	2943	0	2665	2670	2920	2912	Continuing	Continuing

A. <u>Mission Description and Budget Item Justification:</u> Project DB45 – Aircrew Integrated Systems (ACIS) Advanced Development: This project provides advanced development for those systems and items of equipment that are unique and necessary to the sustainment, survivability, and performance of Army aircrews and troops on the future integrated battlefield and related training missions. Advanced development programs will focus on the development and evaluation of emerging technologies and the adaptation of commercial and nondevelopmental items (NDI) to military requirements. The Air Warrior (AW) program will provide the aircrew with a systems approach to chemical and biological (CB) protection, noise protection, microclimatic conditioning, crash and post-crash survivability, concealment and environmental protection, ballistic protection, night vision capability, heads-up displays, directed energy eye protection, and flame/heat protection. The AW design will improve overall aircrew mission performance, aircrew comfort, aircrew and aircrew station interface, safety, and survivability. The Aircrew Integrated Common Helmet (AICH) program (an Air Warrior program component) is the major information management, control, and aircraft interface for the aviator. The AICH incorporates a helmet mounted display, utilizing Comanche compatible optics and electronics with the advanced HGU-56/P helmet. The Virtual Retinal Display (VRD) development effort evaluates VRD technology for incorporation into helmet mounted displays of Army aircrews. The Virtual Cockpit Optimization Program (VCOP) demonstrates an integrated system providing pilots with improved intuitiveness, sense of awareness, overall aircrew mission performance, aircrew and aircrew station interface, safety, and survivability by providing the pilot with augmented visionics, three-dimensional audio improvements, and visual data regarding aircraft systems status and operation, threat warnings, and improved transition and training of pilots who must operate a number of different aircraft platforms during different missions. This project in this Program Element does not duplicate any aircraft platform program efforts. Both joint and service independent efforts continue to be pursued under the scope of this project.

FY 1999 Accomplishments:

- 2408 Completed basic Air Warrior PDRR effort, and begin studies of emerging technologies for insertion into the basic Air Warrior ensemble
- 3797 Began Virtual Cockpit Optimization Program (VCOP) PDRR effort

Total 6205

FY 2000 Planned Program:

- 2864 Continue Virtual Cockpit Optimization Program (VCOP) PDRR effort
- 79 Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)

Total 2943

FY 2001 Planned Program: Project not funded in FY 2001

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)	DATE February 2000
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	PROJECT DB45

B. Other Program Funding Summary	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	To Compl	Total Cost
RDTE, A Budget Activity 5 PE 0604801A Project DC45 (Aircrew Integrated Systems – EMD)	11056	13439	7104	2254	2274	2561	2577	Cont	Cont
Aircraft Procurement, Army (APA) SSN AZ3110 Aircrew Integrated Systems which represents the Entire APA program for ACIS	8972	17167	3490	22193	34072	56619	56535	Cont	Cont

C. Acquisition Strategy: DB45 – An Air Warrior Program Definition and Risk Reduction development contract was awarded in FY 97 to perform a functional requirements analysis and consider user requirements and available technologies to optimize recommended alternatives within the constraints of cost as an independent variable. The Air Warrior basic ensemble program was approved to proceed into an engineering manufacturing development system life cycle phase in 1st Quarter, FY 1999. Currently, a combined government and contractor team is developing Air Warrior improvements and integrating those components into a basic Air Warrior ensemble that will be integrated with the force modernization aircraft. Prototypes will be developed that represent the basic Air Warrior ensemble for test and evaluation. The Air Warrior aircraft platform specific nonrecurring production engineering will begin during FY 02 in preparation for basic ensemble production, aircraft integration, and fielding. Through a combined government and contractor team, the Virtual Cockpit Optimization Program Definition and Risk Reduction effort will investigate and demonstrate how a future rotary wing crewstation could be crafted to deal effectively with information overload on the digital battlefield.

D. Schedule Profile	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Air Warrior Milestone II approved	1Qtr						
EMD for Air Warrior basic ensemble	4Qtr	4Qtr	4Qtr	4Qtr			
Development of Technical Insertion Plan	4Qtr						
Air Warrior Preliminary Design Review		3Qtr					
Critical Design Review and initial Prototype Development		4Qtr					
Air Warrior System Test (Development/Qualification)			1Qtr				
Begin Air Warrior nonrecurring production engineering integration into aircraft platforms				1Qtr			
Continuous evaluation, test and insertion of new technologies as Air Warrior product improvements				4Qtr	4Qtr	4Qtr	4Qtr
Air Warrior basic ensemble Milestone III					1Qtr		
Production of the basic Air Warrior ensemble and aircraft platform specific integration components during FY2002 through outyears					1Qtr	4Qtr	4Qtr

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PE NUMBER AND TITLE: 0603801A Aviation - Advanced Development

PROJECT: DB45

D. Schedule Profile	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Air Warrior basic ensemble IOC						1Qtr	
Production of Air Warrior ensemble product improvements as emerging technologies can be inserted during FY 2003 through outyears						4Qtr	4Qtr
Virtual Cockpit Optimization Program (VCOP) components study in (APEX) simulator	4Qtr	4Qtr					